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DISK DRIVE
[DEISUKU KUDO SOCHI]

HIROSHI SUZUKI

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INVENTOR(S)	(72):	SUZUKI, HIROSHI
APPLICANT(S)	(71):	NEC YONEZAWA LTD.
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[Claims]

[Claim 1]

A disk drive provided with a disk-shaped information recording means wherein information is recorded along the peripheral direction as well as a rotation means used to rotate the abovementioned disk-shaped information recording means, the invention characterized as a disk drive as follows:

the abovementioned rotation means is provided with a spiral mark made for at least one circuit facing the peripheral edge part from the vicinity of the center part of the circumference; a disk having an index mark made at the beginning point and the ending point of the abovementioned spiral mark is mounted so that it rotates along with the abovementioned disk-shaped information recording medium; a position detecting means used to detect the position of the abovementioned spiral mark relative to the rotation position of the abovementioned disk is mounted so that it is fixed to the abovementioned rotation means; the absolute amount of the direction of displacement of the position of the center of gravity of the abovementioned disk-shaped information recording means as well as the eccentric moment

of the center of gravity are measured based on the position of the abovementioned spiral mark relative to the position of rotation detected by the abovementioned position detection means;

[Claim 2]

A disk drive as described in Claim 1 wherein an arrow mark is placed so that it is fixed in the vicinity of the abovementioned disk-shaped information recording medium, the abovementioned arrow mark designates the position which is farthest from the decentered center of gravity of the abovementioned disk shaped information medium;

[Claim 3]

A disk drive as described in Claim 2 wherein the position of the abovementioned disk-shaped information recording medium designated by the abovementioned arrow mark is the position which offsets the eccentric moment of the abovementioned center of gravity;

[Claim 4]

A disk drive as described in any of Claims 1 through 3 wherein the rotation position of the abovementioned disk is converted to time when the abovementioned rotation means rotates at a constant rate;

[Claim 5]

A disk drive as described in any of Claims 1 through 4 wherein the abovementioned position detection means is a CCD line sensor;

[Claim 6]

A disk drive as described in any of Claims 1 through 5 characterized as follows: a balancer having the desired weight is mounted at a position at which the eccentricity of the center of gravity of the abovementioned disk-shaped information recording medium is balanced by using the absolute amount of the direction of displacement of the position of the center of gravity of the abovementioned disk-shaped information recording medium, measured based on the detection by the abovementioned position detection device, as well as the eccentric moment;

[Claim 7]

A disk drive as indicated in Claim 6 wherein the abovementioned balancer is a sticker which can be easily stuck to the surface of the abovementioned disk-shaped information recording medium;

[Claim 8]

A disk drive as described in any of Claims 1 through 7 wherein the disk-shaped information recording means is a CD-ROM medium or a DVD-ROM medium;

[Claim 9]

A disk drive as described in any of Claims 1 through 8 wherein the abovementioned disk drive is loaded on a personal computer.

[Detailed Description of Invention]

[0001]

[Technical Field]

The present invention relates to a disk drive which can measure the bias of the center of gravity in a CD-ROM, DVD-ROM and other disk-shaped information recording medium.

[0002]

[Prior Art]

The performance of disk drives used for notebook personal computers is being improved by making them smaller and thinner and by increasing the number of rotations for the CD-ROM and DVD media to accelerate the reading speed. In particular, CD-ROM media themselves use music CD specifications as is and write data for the computer and the specifications and structure do not take high-speed rotation into consideration. As a result, when there is a bias on the center of gravity (hereinafter, "mass eccentricity") of these recording media due to structural

dispersions, vibration occurs on the recording medium. In particular, the more quickly the recording medium rotates and the lighter it is, the more pronounced the vibrations.

[0003]

Moreover, when it is impossible to read the software, and a device is used which is capable of deciding that the center of gravity of the rotation recording medium has been displaced and which can reduce the number of rotations, it is sometimes impossible to make a distinction that read cannot be carried out due not only to vibrations but to other factors as well and the number of rotations is sometimes reduced.

[0004]

Therefore, Unexamined Patent 6-84152 discloses a method wherein fine particle-balancers are coated on the modified surfaces placed on the rotor in order to remove dynamic unbalances in rotors as a method for reducing vibrations when a recording medium is rotated. When this technique is used, dynamic unbalances in the rotor can be modified at high precision by coating fine particles on the modified surface whereon a graduation is placed on the periphery of the rotor. Moreover, Unexamined Patent 10-

83580 describes a technique for detecting the surface deflection of a rotating recording medium. This technique involves reflecting laser light radiated from a laser Doppler speedometer onto an optical disk, detecting the incline of the rotor from the zero-order diffraction reflected light, detecting the eccentricity of the rotor from the primary diffraction reflected light and measuring the surface deflection of the optical disk.

[0005]

[Problems Which the Present Invention is Intended to Solve]

However, when the method used to measure the optical surface deflection using the technique described in Unexamined Patent 10-83580 was used, the device was complicated and large and could not be made small enough to be built into a notebook personal computer. Moreover, although the modification method which alleviated the surface deflection and vibration using the technique described in Unexamined Patent 6-84152 could be carried out for shipment inspection and the like at plants, the

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modification could not be carried out in simple fashion after the units were shipped or when the disk drive was delivered personally to the user. Moreover, no eccentricity

measuring technique or vibration absorption technique suitable for a disk drive small enough to be built into a notebook personal computer has been disclosed in any other conventional techniques.

[0006]

Taking this situation into consideration, it is an object of the present invention to provide a disk drive which is small-scale and inexpensive, which can measure the eccentricity of a disk-shaped information recording medium at high precision and which compensates for eccentricity in an uncomplicated manner.

[0007]

[Means Used to Solve the Problems]

The disk drive in the present invention writes spiral lines on a disk which rotates simultaneously with a CD-ROM medium, a DVD medium and other disk-shaped information recording media and reads the spiral lines when these rotate using a CCD (charge coupled device) line sensor. As a result, the direction of the vibration of the rotating disk and the amplitude are read and the amount of deflection of the center of gravity of the disk-shaped information recording medium, that is, the direction of the

eccentric moment and the bias are measured. This means that when there is no rotation vibration when the center of gravity is at the center, the relationship between the rotation and the read position on the CCD line sensor is changed in a linear fashion. However, when the center of gravity is displaced from the center and rotation vibration occurs, the relationship between the rotation position (that is, the rotation time) and the read position on the CCD line sensor changes by deviating from linearity. As a result, when the data are read, the absolute value of the bias of the center of gravity and the direction of the bias can be measured. Then, when a sticker or other balancer is stuck onto the surface of the disk-shaped information recording medium based on the size of the bias of the center of gravity (eccentric moment) and the direction of the bias, a balance with the eccentricity can be maintained and vibrations of the drive itself caused by the eccentricity can be prevented.

[0008]

This means that the disk drive in the present invention is provided with a disk-shaped information recording means on which information is recorded in the direction of the periphery as well as a rotation means used

to rotate the disk-shaped information recording means, the invention characterized as having a spiral mark placed on the rotation means on at least one circuit facing the peripheral edge part from the vicinity of the center part of the circumference, a disk on which an index mark is placed on the starting point and ending point of the spiral mark is mounted so that it rotates along with the disk-shaped information recording medium and a position detection means used to detect the position of the spiral mark relative to the rotation position of the disk is mounted so that it is fixed to the rotation means and the absolute amount of the direction of deflection of the position of the center of gravity of the disk-shaped information recording medium and the eccentric moment of the center of gravity are measured based on the position of the spiral mark of the disk-shaped information recording medium.

[0009]

It is also characteristic in that an arrow mark is placed in the vicinity of the disk-shaped information recording medium while in a fixed state and the arrow mark designates the position which is farthest from the center of gravity which is decentered from the disk-shaped

information recording medium based on the direction of the displacement of the position of the center of gravity of the disk-shaped information recording medium detected by the position detection means. Moreover, the position of the disk-shaped information recording medium designated by this arrow mark is a position which offsets the eccentric moment of the center of gravity. Furthermore, when the rotation means rotates at a constant speed, the rotation position of the disk may be converted to time. Moreover, a CCD line sensor serves all purposes and is suitable as the position detection means.

[0010]

The disk-shaped drive in the present invention is also characteristic in that a balancer having a prescribed weight is mounted at a position which balances the eccentricity of the center of gravity of the disk-shaped information recording medium by using the absolute amount of the direction of the displacement of the position of the center of gravity of the disk-shaped information recording medium measured based on detection by the position detection means as well as of the absolute amount of eccentric moment. This balancer should be a sticker which

can be easily stuck to the surface of the disk-shaped information recording medium.

[0011]

The disk-shaped information recording means is also characteristic in that either a CD-ROM medium or DVD-ROM medium is generally used and the disk drive is loaded on a personal computer.

[0012]

[Mode of Working the Present Invention]

Next, we shall provide a detailed description of a mode of working the present invention referring to figures. Figure 1 is a schematic configuration diagram of the disk-shaped drive in the mode of working the present invention when it is a CD-ROM drive. First, we shall describe the configuration of the mode of working it. The CD-ROM drive is configured of CD-ROM medium 1; spin motor 2 used to rotate this; disk 3 having a spiral mark which is directly coupled to this spin motor 2 by a shaft and which rotates along with it; CCD line sensor 4 used to read spiral mark 7; and arrow mark 6 which indicates a graduation for the position of the eccentricity of pickup 5 which reads the information in CD-ROM medium 1 and CD-ROM medium 1.

Needless to say, CD-ROM 1 may be a DVD-ROM medium, however, operations will be carried out from this point on using a CD-ROM medium.

[0013]

CD-ROM medium 1 and disk 3 with the spiral mark attached to it rotate coaxially by virtue of the abovementioned configuration. Moreover, CCD line sensor 4 is disposed so that it is fixed relative to the rotation of spin motor 2. When spindle motor 2 rotates while being supported in the packing crate using a vibration prevention spring, CCD line sensor 4 is configured so that it reads the periphery of disk 3 with the spiral mark attached. Furthermore, pickup 5 is disposed so that it is fixed relative the rotation of spindle motor 2 so that information on the periphery of CD-ROM medium 1 which rotates can be read. Moreover, arrow mark 6 is fixed at a constant position.

[0014]

Figure 2 is an enlarged view of disk 3 with the spiral mark attached in Figure 1. In this figure, spiral mark 7 is drawn facing the peripheral edge part from the vicinity of the center along one circuit of the periphery

of disk 3 with the spiral mark attached. Index mark 8 is inscribed at a position which indicates the beginning point and the ending point thereof. Any spiral mark 7 and index mark 8 may be used as long as the light can be reflected to

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CCD line sensor 4.

[0015]

Next, we shall explain operations for the mode of working the present invention. Figure 3 is a diagram indicating the properties when CD-ROM medium 1 is rotated and the position of spiral mark 7 is read by CCD line sensor 4. Rotation time is indicated on the vertical axis and the position at which CCD line sensor 4 on which a light receiving part is arranged in a straight line takes spiral mark 7 as the change in the charge is indicated on the horizontal axis.

[0016]

First, we shall explain how CD-ROM medium 1 is measured when the center of gravity is ideally at the center. When spindle motor 2 turns and CCD line sensor 4 reads spiral mark 7, the read position of spiral mark 7 relative to the rotation position (that is, time) changes

in a linear fashion and the starting point of index mark 8 is read each time it makes one rotation. As a result, a saw-like wavy linear inclined waveform 11 having as starting point index position 9 is obtained, as indicated by the unbroken line in Figure 3.

[0017]

Despite this, when the center of gravity of CD-ROM medium 1 inclines from the center and spindle motor 2 rotates, vibrations are caused and spiral marked disk 3 vibrates in concert with this. As a result, read locus data from spiral mark 7 read by CCD line sensor 4 become non-linear inclined waveform 10, as indicated by the broken line in Figure 3. This means that this non-linear inclined waveform 10 is displaced on one side or on both sides relative to linear inclined waveform 11 when the center of gravity is in the middle and it becomes a non-linear waveform which vibrates. The direction of the displacement from the center of gravity of the CD-ROM medium as well as the size of the eccentricity can be found from the absolute value (amplitude) of the displacement relative to linear inclined waveform 11 of this non-linear inclined waveform 10 as well as the direction of displacement.

[0018]

When the rotation of spindle motor 2 is stopped based on the direction of displacement measured in this way, the rotation position of CD-ROM medium 1 which has the greatest displacement in the negative direction, that is, the lightest position of CD-ROM medium 1, is adapted to the position indicated by arrow mark 6 and the rotation is stopped. Then, a sticker having a weight calculated according to the absolute amount of displacement is stuck at the position of CD-ROM medium 1 which corresponds to the position of arrow mark 6. As a result, a balance can be achieved for the center of gravity of CD-ROM medium 1.

[0019]

We found the amount of bias and the direction of bias of the center of gravity of CD-ROM medium 1 by measuring the direction of displacement and the amount of displacement of non-linear inclined waveform 10, indicated by the broken line, relative to linear inclined waveform 11, indicated by the unbroken line in Figure 3. This means that the rotation position of CD-ROM medium 1, corresponding to the maximum point 12 at which non-linear inclined waveform 10 exhibits the greatest displacement in the negative direction, is considered the position at which

the center of gravity is displaced to the outside and the weight is determined by the amount of displacement in the negative direction. Moreover, the rotation position of CD-ROM medium 1, corresponding to the maximum point 13, at which non-linear inclined waveform 10 exhibits the greatest displacement in the positive direction becomes the side opposite the maximum point 12 of displacement in the negative direction. This means that it becomes the lightest position for CD-ROM medium 1.

[0020]

As indicated above, the dynamic balance of the CD-ROM can be easily established by measuring the direction of displacement of the center of gravity of the CD-ROM medium and the weight of the eccentricity and sticking a sticker and other balancer at the prescribed position. Moreover, it can be easily mounted on a personal computer and other small-scale device and the dynamic balance of the CD-ROM medium can be established simply even for disk drives which have already been shipped.

[0021]

The mode of working the invention indicated above is one example of explaining the present invention and it

should by no means be construed that the present invention is restricted to this mode. A number of variations may be used as long as they are in line with the parameters of the gist of the invention. This means that the abovementioned mode of working the invention was explained in the case of a CD-ROM. Needless to say, however, it may be applied as well even for a DVD-ROM medium and an optical magnetic disk or any other type of rotation type information recording medium.

[0022]

[Effect of Invention]

As has already been explained, the disk drive in the present invention has been made smaller and lighter like a CD-ROM read device and a DVD read device for notebook personal computer. Even if sufficient structural vibration countermeasures are not taken, the dynamic balance for a CD-ROM medium and the like can be measured merely by adding a simple device. Then, a sticker can be stuck to a CD-ROM medium and the like as a balancer and the dynamic balance of the CD-ROM and others can be established by using the same type of method as used for establishing the wheel balance of automobile tires.

[Brief Explanation of Figures]

[Figure 1] A schematic configuration diagram indicating the disk drive in the mode of working the present invention when it is a CD-ROM drive.

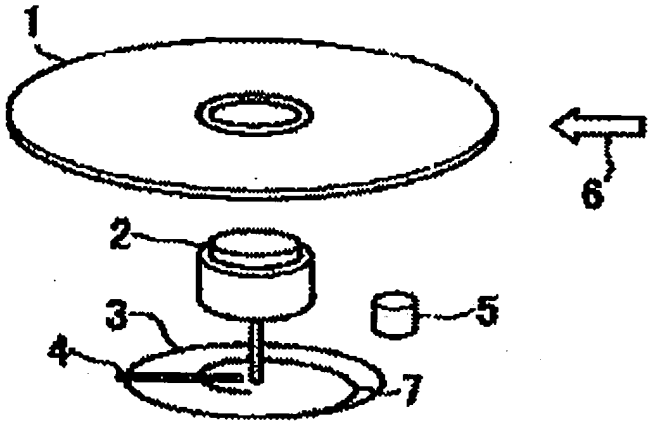
[Figure 2] An enlarged view of disk 3 with the spiral mark attached in Figure 1.

[Figure 3] A diagram indicating the properties when CD-ROM medium 1 is rotated and the position of spiral mark 7 is read by CCD line sensor 4.

[Explanation of Notation]

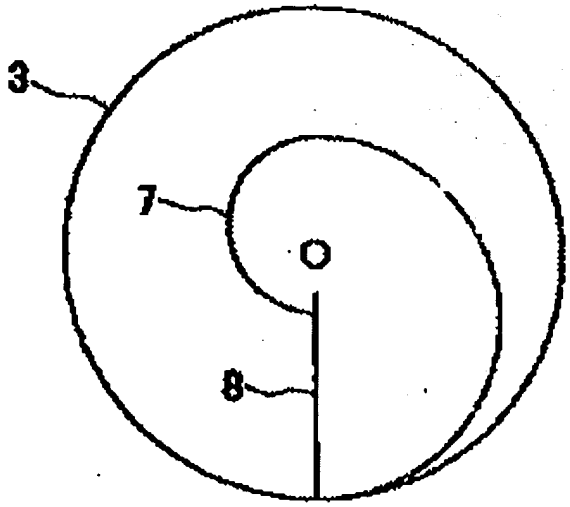
1..CD-ROM medium; 2..spindle motor; 3..disk with spiral mark attached; 4..CCD line sensor; 5..pickup; 6..arrow mark; 7..spiral mark; 8..index mark; 9..index position; 10..non-linear inclined waveform; 11..linear inclined waveform; 12..maximum point of displacement of position in the negative direction; 13..maximum point of displacement of position in the positive direction

【図1】



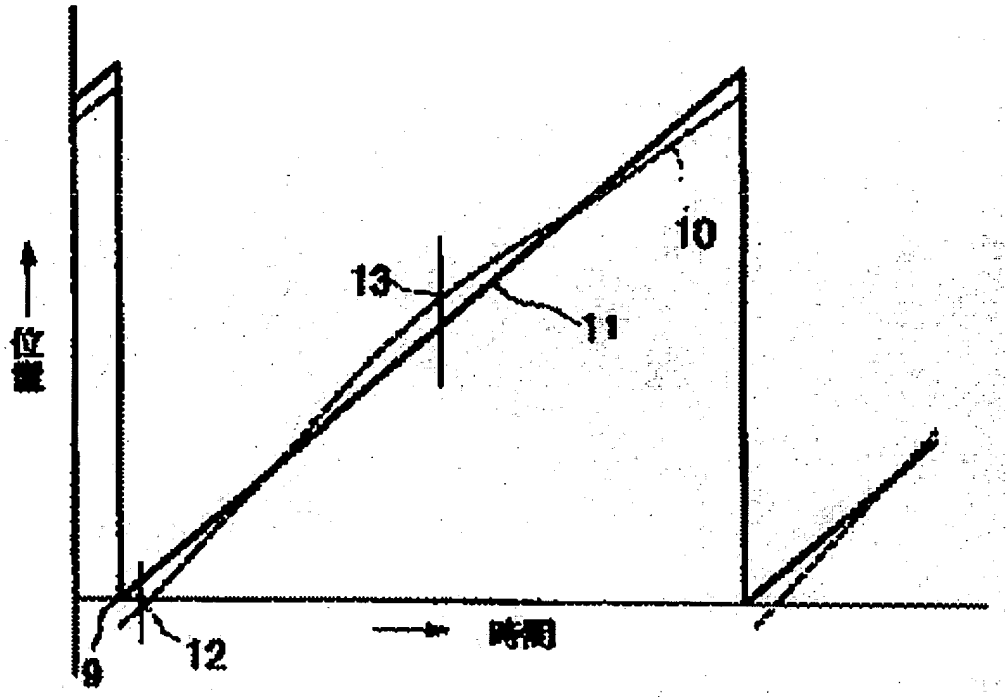
[Figure 1]

【図2】



[Figure 2]

【図3】



[Figure 3]

[captions:

Left margin: position ↑

Beneath figure: → time